

PATENT APPLICATION TRANSMITTAL LETTER

Docket Number (Optional)

F 5964C

To the Commissioner of Patents and Trademarks:

Transmitted herewith for filing under 35 U.S.C. 111 and 37 CFR 1.53 is the patent application of
STEVEN KARNEY AND EDWARD FRIELEINGentitled WATERCRAFT STABILIZED BY CONTROLLED
HYDROFOIL ELEVATIONPRO
JCS 40 U 19/98
11/23/98

Enclosed are:

11 pages of written description, claims and abstract.

1 sheets of drawings.

an assignment of the invention to _____

executed declaration of the inventors.

a certified copy of a _____ application.

associate power of attorney.

a verified statement to establish small entity status under 37 CFR 1.9 and 1.27.

information disclosure statement

preliminary amendment

other: *PETITION + DECLARATION TO MAKE SPECIAL/AGE*
EXPRESS MAIL CERTIFIED MAIL 11/23/98

CLAIMS AS FILED

	NUMBER FILED	NUMBER EXTRA	RATE	FEES
BASIC FEE			\$710	\$710
TOTAL CLAIMS	13 - 20 = * 0		X \$22	
INDEPENDENT CLAIMS	2 - 3 = * 0		X \$74	
MULTIPLE DEPENDENT CLAIM PRESENT			\$230	
* NUMBER EXTRA MUST BE ZERO OR LARGER			TOTAL	\$
If applicant has small entity status under 37 CFR 1.9 and 1.27, then divide total fee by 2, and enter amount here.				SMALL ENTITY TOTAL \$ 395 ⁰⁰

A check in the amount of \$ 395⁰⁰ to cover the filing fee is enclosed.

The Commissioner is hereby authorized to charge and credit Deposit Account No. _____ as described below. I have enclosed a duplicate copy of this sheet.

Charge the amount of \$ _____ as filing fee.

Credit any overpayment.

Charge any additional filing fees required under 37 CFR 1.16 and 1.17.

Charge the issue fee set in 37 CFR 1.18 at the mailing of the Notice of Allowance, pursuant to 37 CFR 1.311(b).

11/23/98

Date

Alvin S. Blum

Signature

Alvin S. Blum Reg. 30,448

Typed or printed name

2350 Del Mar Place

Address

Fort Lauderdale, FL 33301

Watercraft Stabilized By Controlled Hydrofoil Elevation

This invention is a continuation in part of copending U.S. Patent application serial number 08/646,849 filed 5/8/96.

Field of the Invention

This invention relates to watercraft and more particularly to means for stabilizing watercraft at high speed by controlled elevation of hydrofoils or pontoons extending beneath the hull.

Background of the Invention

High speed boats that rise up to plane with the hull at least partially out of the water are vulnerable to rolling over and capsizing, especially in a sharp turn. Boats with hydrofoils or pontoons beneath the hull are capable of very high speeds. However, because of their high center of gravity, they are even more vulnerable to rolling over at high speeds, and/or in rough seas. Some of these watercraft are limited to only 5 degree turns at speeds of 125 miles per hour. It would be desirable to have a mechanism associated with hydrofoil elevation and retraction that would further stabilize the vessel at high speeds.

Summary of the Invention

It is accordingly an object of the invention to provide a stabilizing mechanism to a high speed watercraft associated with hydrofoils that are individually vertically retractable and extensible to overcome rolling and pitching forces, especially those forces associated with high speed turns. The hydrofoils or pontoons may be retracted or extended under computer control in response to signals from one or more sensors related to water speed, propeller rotation, roll angle, and rudder angle. Each hydrofoil may be supported by separate fore and aft individually powered supports. A pitch angle sensor may also provide signals to the computer control for separate fore and aft hydrofoil support adjustments to modify the pitch angle or attitude of the vessel. The pitch adjustment may also be used for most efficient attitude adjustment during operation independent of the pitch angle.

sensor.

These and other objects, advantages and features of the invention will become more apparent when the detailed description is studied in conjunction with the drawings in which like reference characters designate like elements in the various drawing figures.

Brief Description of the Drawings

Fig. 1 is a perspective diagrammatic view, partially broken away, of a watercraft of the invention.

Fig. 2 is a perspective view of a roll angle sensor.

Fig. 3 is a perspective exploded view, partially broken away, of a hydraulically powered hydrofoil support.

Fig. 4 is a side elevation view of another watercraft embodiment of the invention.

Fig. 5 is a rear elevation view of the watercraft shown in Fig. 4.

Fig. 6 is a partial side elevation view of another embodiment of the invention.

Detailed Description of Preferred Embodiments

Referring now first to Figs. 1-3, a high speed watercraft 29 of the invention is powered by internal combustion engine/electric generator 14 which provides electric power to electric propulsion motors 28 which drive propellers 27. The motors 28 are within pontoons or hydrofoils 5 and 6 that adjustably retract and extend below hull 29 to stabilize the hull and enhance high speed operation. Starboard hydrofoil 5 is connected to the hull by fore hydrofoil support 7 and aft support 8. Port hydrofoil 6 is connected to the hull by supports 9 and 10. Each support comprises a connector 15 that bolts to the pontoon and pivotally connects to piston shaft 16. Each piston head 17 is driven up or down within hydraulic cylinder 18 by hydraulic fluid through hoses 19,20 from a hydraulic pump and control 21 driven by engine 14. Hose lines and electric lines interconnecting various elements in the drawings have been omitted for clarity. The hydrofoil supports may be powered by other means such as rack and pinion. Hydraulic control maintains the degree of extension of each of the hydrofoils separately. It can also, by adjusting fore and aft supports separately, adjust the attitude of the foil relative to the hull for optimal performance. The hydraulic control is in turn controlled by a computer 23. The degree of extension of each support may be sensed by a proximity sensor 24 within the piston. This may be, for example, but not limited to, an ultrasonic sensor.

The computer 23 also receives signals for additional sensors to be used by the computer in determining when and how to extend or retract the hydrofoil supports for optimal performance. A turning mechanism such as a rudder 3 includes a rotary position indicator to provide a rudder angle signal. A pendulum type roll angle sensor 12 is best seen in Fig. 2. Two supports 25 pivotally support a shaft 26 with a pendulum weight 30. A rotary position indicator 31 connected between support 25 and shaft 26 provides a roll angle signal to computer 23. A dashpot 32 may damp out short term movements. The roll sensor 12 is mounted in the hull with the shaft parallel to the roll axis 1. A similarly constructed pitch

angle sensor 13 is mounted with its shaft parallel to the pitch axis 2 to provide a pitch angle signal to the computer 23. A tachometer 33 at each propeller shaft provide a signal to the computer of each propeller rotation rate. A water speed sensor 4 provides a signal to the computer of the speed of the hull over the water. A manual control of hydrofoil supports is also provided to the computer. The propellers, extending from the hydrofoils, are always at the water level, even when the hull is completely above water where it may run in a heavy sea at considerably higher speeds as is well known in the art. The propeller motors may alternatively be hydraulic motors. Water intakes 34 for cooling engine 14 and also, optionally, for cooling drive motors 28 may also be provided at the hydrofoils to provide cooling water at any hydrofoil elevation. Hydraulic and cooling hoses are not shown.

Referring now to Figs. 4 and 5, another embodiment of the invention is shown in which the propeller 35 is driven by a shaft 36 within a keel 37 extending downward from the main hull and connected to engine 38. Hydrofoils 5', 6' recess into the hull when retracted. In a sharp turn at high speed, the hull might roll enough to the outside of the turn to lift the propeller out of the water and to cause the hull to slide sideways. Extending the hydrofoil on the outside of the turn more than the hydrofoil on the inside of the turn, creates a banking condition, reducing the roll tendency and the sideways motion. In this configuration, the amount of elevation of the hull is limited by the fixed propeller position. It has advantages in direct propeller drive and fixed cooling water pickup.

Referring now to Fig. 6, another embodiment of the invention is shown in which propulsion is provided by one or more outboard motors 37 mounted on a vertically adjustable motor mount 38 that is bolted to the transom 39. The vertical movement of mount 38 may be by a helical screw or hydraulic piston, for example. The elevation of the outboard propulsion means is controlled by the computer to maintain the propeller in optimum position as the hydrofoil elevation changes. The embodiments of Figs. 1 and 6 enable the

hull to travel in very shallow waters as the propeller elevation may be easily adjusted.

Computer Control of Hydrofoil Extension

The vessel at high speeds may perform like a catamaran with the hydrofoils extended to lift the hull at least partially above the water level. Roll and pitch may be at least partially corrected by the relative degree of extension of the hydrofoil supports. The computer controls the degree of extension of each of the hydrofoil supports using at least one and preferably many of the input signals from the various sensors as required to control roll and pitch and even to adjust in anticipation of rolling and pitching that will come about from the various conditions that are sensed. Control of an element or elements by a computer on the basis of multiple independent variables is well known in the art. Each hull and hydrofoil configuration is going to roll or pitch at different rates of turning angle, which may be determined by rudder angle and propeller shaft turning rates; over water speeds; and hydrofoil elevation, that will require different rates and amounts of compensating retraction of the hydrofoil supports. These requirements may be estimated by computer simulation and further refined by empirical determination in actual hull operation. Additional corrections may have to be made for hull load distribution and wind velocity and direction. These effects may be best determined by the roll and pitch sensors whose signals are also used by the computer. The values of all the parameters are stored in a look up table in the computer. At a particular speed and turning angle and roll and pitch angles, the values are entered into the look up table and corresponding amounts of extension of each of the hydrofoil supports is found and applied to the supports to adjust for most stable operation. The initial values in the look up table may be refined by repeated empirical observations under actual use conditions, including interpolation between initial coarse values.

The above disclosed invention has a number of particular features which should preferably be employed in combination although each is useful separately without departure from the scope of the invention. While I have shown and described the preferred embodiments of my invention, it will be understood that the invention may be embodied otherwise than as herein specifically illustrated or described, and that certain changes in the form and arrangement of parts and the specific manner of practicing the invention may be made within the underlying idea or principles of the invention within the scope of the appended claims.

6

What is claimed is:

1. A watercraft having a hull with a roll axis extending along the direction of travel and a pitch axis athwartship and transverse to the roll axis, the watercraft comprising:

first and second elongate, vertically retractable and extensible hydrofoils mounted to the underside of the hull and having long axes parallel to the roll axis and on either side thereof by separate hydrofoil supports; power means operatively connected to the hydrofoil supports for selectively extending or retracting each hydrofoil individually;

roll sensor means mounted in the hull and having a rotational axis parallel to the roll axis for sensing roll angle and generating roll signals therefrom;

a turning mechanism connected to the hull for turning the forward motion of the hull through a turning angle; and control means interconnecting the power means and the roll sensor means for altering the relative extension of the two hydrofoils to reduce the roll tendency of the hull in response to the roll signal.

2. The watercraft according to claim 1 further comprising: turn sensor means operatively connected to the turning mechanism for generating turn signals related to the turning angle; and the control means further interconnected to the turn sensor means for altering the relative extension of the two hydrofoils to reduce the roll tendency of the hull in response to at least one of the roll signal and the turn signal.

3. The watercraft according to claim 2, further comprising:

pitch sensor means mounted in the hull and having a rotational axis parallel to the pitch axis for sensing pitch angle and generating pitch signals related to the pitch angle; each hydrofoil being supported by separately extensible and retractable fore and aft supports separately adjustable by

the power means; and the control means further interconnected to the pitch sensor means for altering the attitude of the hull by selectively adjusting the fore and aft supports in response to signals from the pitch sensor means.

4. The watercraft according to claim 3 further comprising velocity sensing means connected to the hull for generating velocity signals related to the velocity of the hull, and the control means further interconnected to the velocity sensing means to selectively modify the hydrofoil elevation and retraction in response to the velocity signals.

5. The watercraft according to claim 2 further comprising velocity sensing means connected to the hull for generating velocity signals related to the velocity of the hull, and the control means further interconnected to the velocity sensing means to selectively modify the hydrofoil elevation and retraction in response to the velocity signals.

6. The watercraft according to claim 1 further comprising velocity sensing means connected to the hull for generating velocity signals related to the velocity of the hull, and the control means further interconnected to the velocity sensing means to selectively modify the hydrofoil elevation and retraction in response to the velocity signals.

7. The watercraft according to claim 5 further comprising fathometer means for sensing water depth connected to the hull and providing depth signals for manual control to further selectively modify the hydrofoil elevation in response to depth signals.

8. The watercraft according to claim 7 further comprising a propulsion means attached to each hydrofoil for propelling the hull that extends and retracts along with the hydrofoil.

9. The watercraft according to claim 1 further comprising a propulsion means attached to each hydrofoil for propelling the hull that extends and retracts along with the

hydrofoil.

10. In a watercraft having a hull with a roll axis extending generally along the direction of travel, a pitch axis athwartship and transverse to the roll axis, a turning mechanism, and a velocity sensing means for providing a velocity signal representing velocity over water, a stabilizing apparatus comprising:

first and second elongate, vertically retractable and extensible hydrofoils mounted by separate hydrofoil supports to the hull and having long axes parallel to the roll axis and on either side thereof;

power means operatively connected to the hydrofoil supports for selectively retracting or extending each hydrofoil individually below the hull;

roll sensor means connected to the hull and having a rotational axis parallel to the roll axis for sensing roll angle and generating a roll signal therefrom;

turn sensor means operatively connected to the turning mechanism and generating a turn angle signal therefrom; and

control means connected for receiving roll signals, turn angle signals, and velocity signals and also connected to the power means for individually altering the extension of the two hydrofoils to reduce roll tendency in response to at least one of the signals.

11. The apparatus according to claim 10 further comprising:

pitch sensor means connected to the hull and having a rotational axis parallel to the pitch axis for sensing pitch angle and generating a pitch signal therefrom;

each hydrofoil being supported by separately retractable and extensible fore and aft supports separately adjustable by the power means; and

the control means being further connected to the pitch sensor means for receiving pitch signals therefrom for altering the attitude of the hull by selective adjustment of the fore and

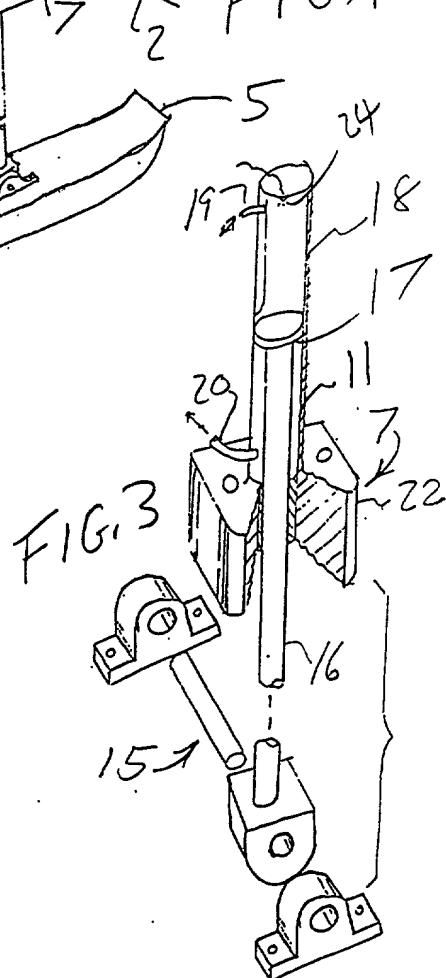
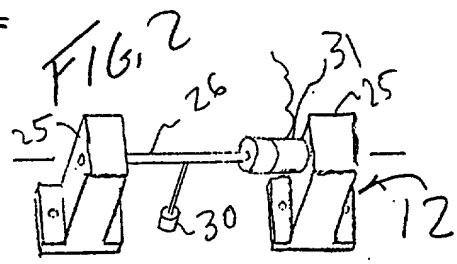
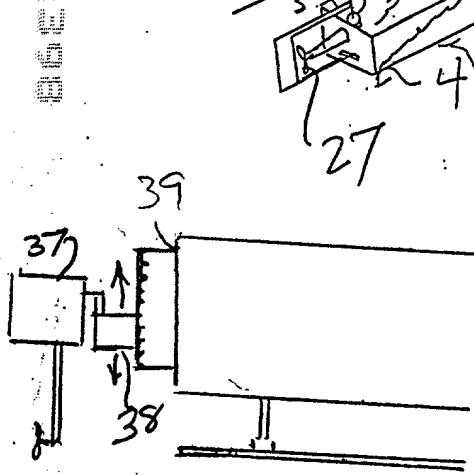
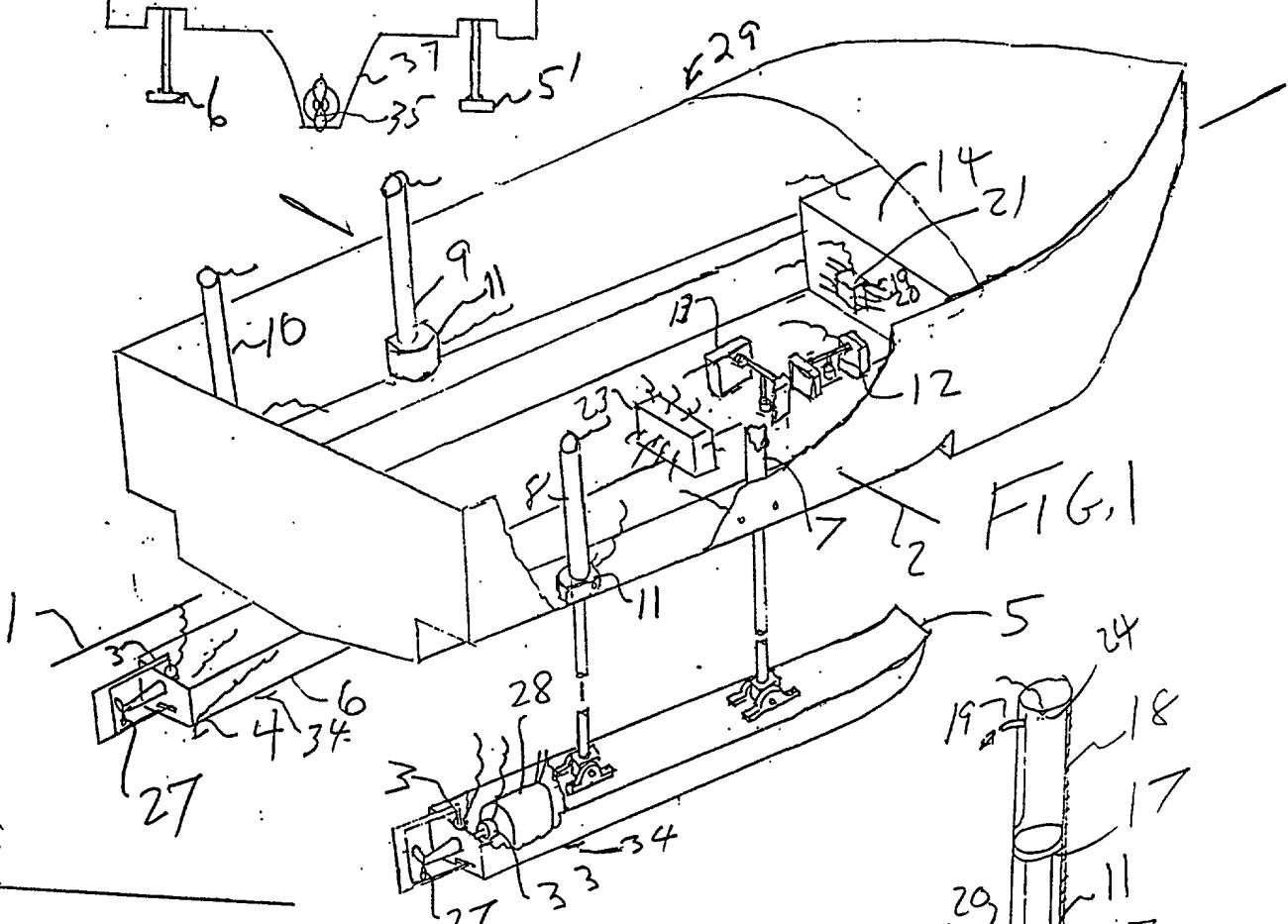
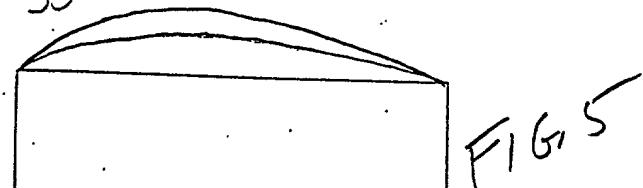
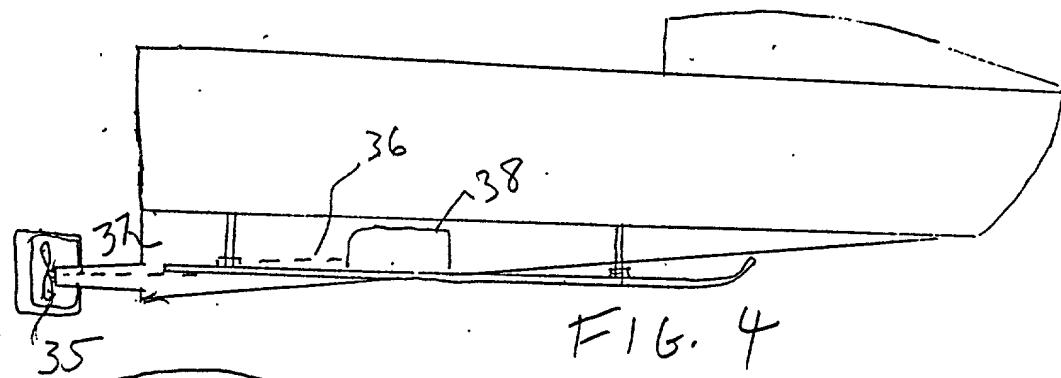
aft supports in response to the pitch signals.

12. The apparatus according to claim 11 further comprising a propulsion means attached to each hydrofoil for propelling the hull that retracts and extends along with the hydrofoil.

13. The apparatus according to claim 10 further comprising a propulsion means attached to each hydrofoil for propelling the hull that retracts and extends along with the hydrofoil.

Abstract

A watercraft has starboard and port hydrofoils or pontoons that are supported by individually powered fore and aft supports for adjustable retraction and extension below the hull under control of a computer using signals from water speed, turn angle, roll angle and pitch angle sensors to maintain stability of operation, especially on high speed turns where the hull may be banked into a turn by positioning the hydrofoil on the inside of the turn lower than the other hydrofoil.



DECLARATION FOR PATENT APPLICATION

Docket Number (Optional)

F 5964C

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled Watercraft Stabilized By Controlled Hydrofoil Elevation, the specification of which

is attached hereto unless the following box is checked:

 was filed on _____ as United States Application Number or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

(Number)	(Country)	(Day/Month/Year Filed)	Priority Claimed <input type="checkbox"/> Yes <input type="checkbox"/> No
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
<u>08/646,849</u>	<u>5/8/96</u>	<u>Pending</u>	
(Application Number)	(Filing Date)	(Status - patented, pending, abandoned)	
(Application Number)	(Filing Date)	(Status - patented, pending, abandoned)	

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Alvin S. Blum

Address all telephone calls to Alvin S. Blum at telephone number (954) 462-5006
Address all correspondence to Alvin S. Blum
2350 Del Mar Place
Fort Lauderdale, FL 33301

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor (given name, family name) Steven KarneyInventor's signature Steven Karney Date 11/23/98
Residence Parkland, Florida Citizenship U.S.A.
Post Office Address 7322 N.W. 58th Way
Parkland, FL 33068Full name of second joint inventor, if any (given name, family name) Edward Frielings
Second Inventor's signature Edward Frielings Date 11/23/98
Residence Delray Beach, Florida Citizenship U.S.A.
Post Office Address 5670 Willow Creek Court
Delray Beach, FL 33484 Additional inventors are being named on separately numbered sheets attached hereto.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of: Docket No. F 5964C
Steven Karney and Edward Frieling

Title: Watercraft Stabilized By Controlled Hydrofoil Elevation

DECLARATION

I, Edward Frieling

hereby declare that:

1. I am an inventor of the invention for which a Patent Application is being presented herewith.

2. I am over the age of sixty-five years. My birth date is Jan. 13, 1925, and I am 73 years old as of this date.

3. This Declaration is being submitted in support of the Petition to Make Special accompanying the above styled Patent Application.

The undersigned, Edward Frieling being hereby warned that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. section 1001, and that such willful false statements may jeopardize the validity of this application or any patent resulting, declares that the facts set forth in this Declaration are true; all statements made of his own knowledge are true; and all statements made on information and belief are believed to be true.

Respectfully submitted,

Date 11/23/98

Edward Frieling

**VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27(b))—INDEPENDENT INVENTOR**

Docket Number (Optional)
F 5964C

Applicant or Patentee: Steven Karney- Edward Frieling

Application or Patent No.: _____

Filed or Issued: _____

Title: Watercraft Stabilized By Controlled Hydrofoil Elevation

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

the specification filed herewith with title as listed above.
 the application identified above.
 the patent identified above.

I have not assigned, granted, conveyed, or licensed, and am under no obligation under contract or law to assign, grant, convey, or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below.

No such person, concern, or organization exists.
 Each such person, concern, or organization is listed below.

Separate verified statements are required from each named person, concern, or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Steven Karney
NAME OF INVENTOR

Signature of Inventor

Date

Edward Frieling
NAME OF INVENTOR

Edward Frieling
Signature of Inventor

11/23/98

Date

NAME OF INVENTOR

Signature of Inventor

Date